

Elizabeth Tomsik

Materials & Processes (M&P) Engineering Internship Projects



Mentor: Clara Wright

Supervisor: Steve McDanels

University of Florida

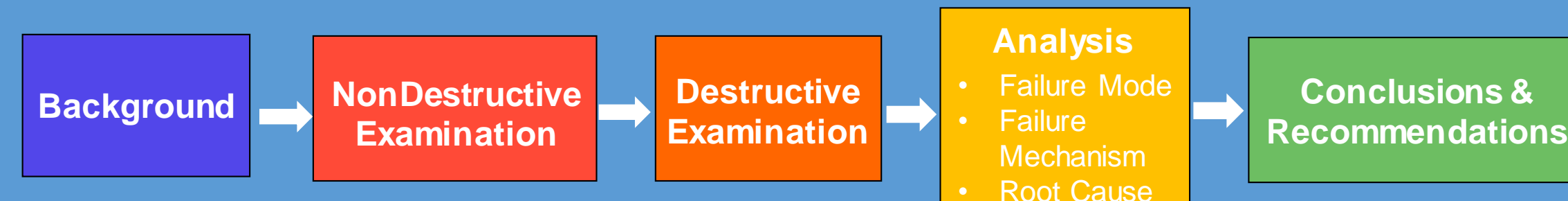
Branch: NE-L4

Graduation: May 2018

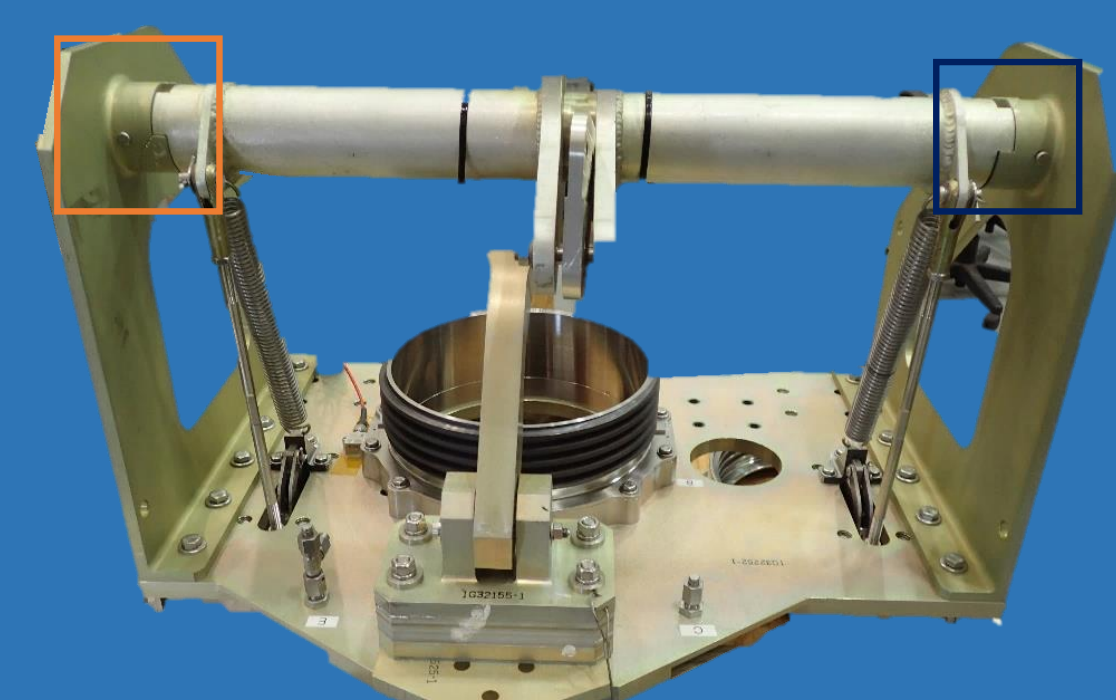
Primary Projects

1. Laboratory Work and Failure Investigations
 - Launch Equipment Test Facility (LETF) Interim Cryogenic Propulsion Stage Umbilical (ICPSU) Ground Plate (Ground Systems Development & Operations (GSDO))
 - Paul Recharger Liquid Oxygen Poppet (Orion, International Space Station (ISS), GSDO, Space Launch System)
 - Li Ion Battery ORU Spring Blade (ISS)
2. Advanced Plant Habitat Materials & Processing (ISS)
3. Magnesium Alloy Research Project (IR&TD)

Failure Investigation Process



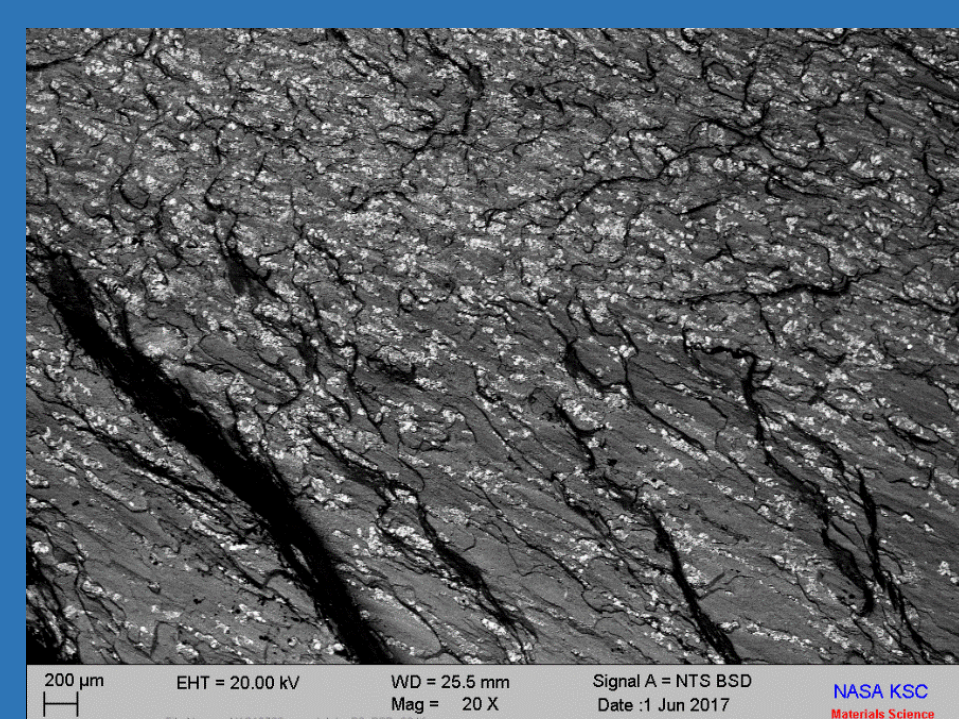
LETF ICPSU Test Ground Plate Failure Investigation



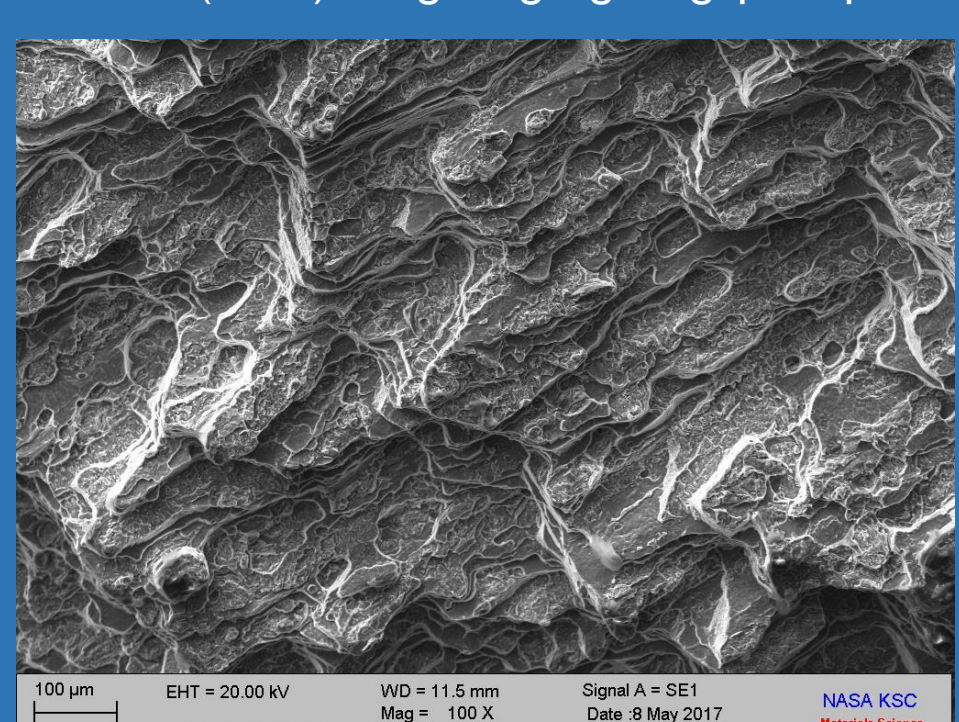
LETF Umbilical Testing configuration photo showing how the Aluminum 7075 T651 ground plates were positioned within the configuration



On-site photo of both failed ground plates before they were removed from original configuration



Scanning Electron Microscope (SEM) Back Scatter Detector (BSD) image highlighting precipitates



SEM Secondary Electron (SE) image showing fracture feature topography



Photo taken while manually opening the crack from overload with a hammer

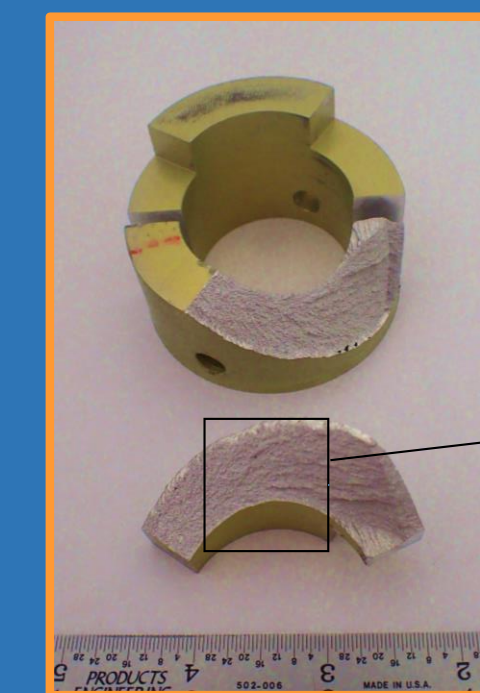
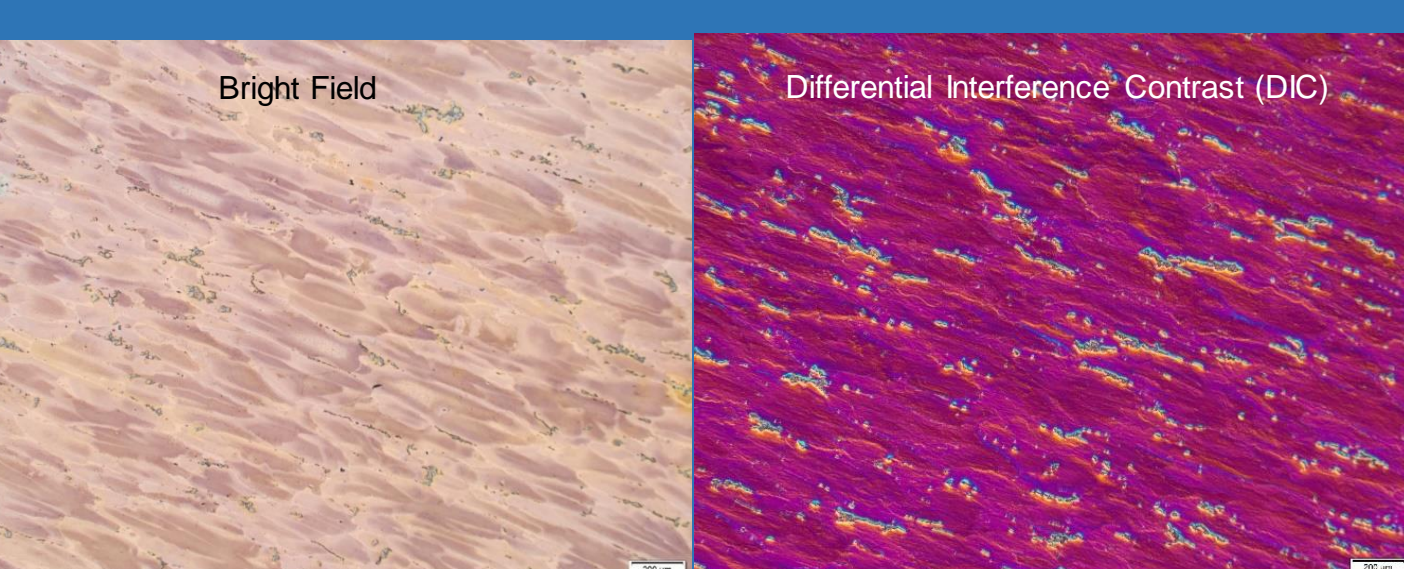
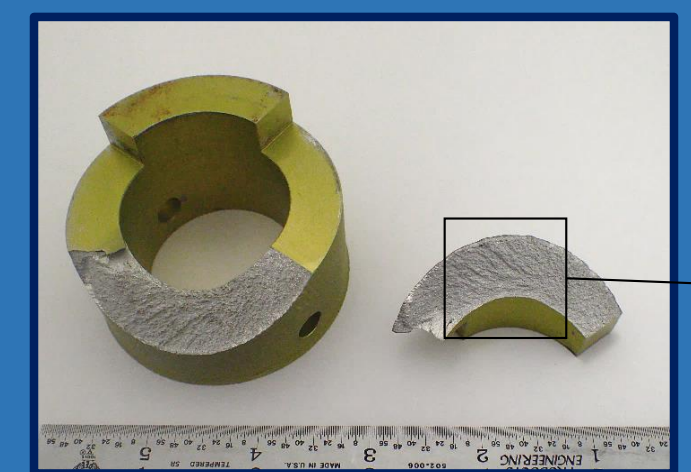


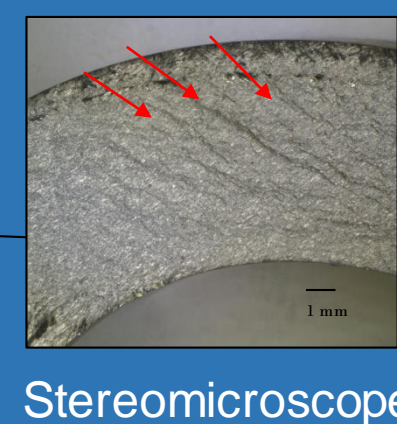
Photo of left ground plate after crack was opened



Inverted Metallograph images at 50X magnification showing microstructure of transverse cross-section after etching



As-received in lab photo of right ground plate



Stereomicroscope photo at 6.3X magnification

R-12 Paul Recharger High Pressure Liquid Oxygen Poppet Failure Investigation



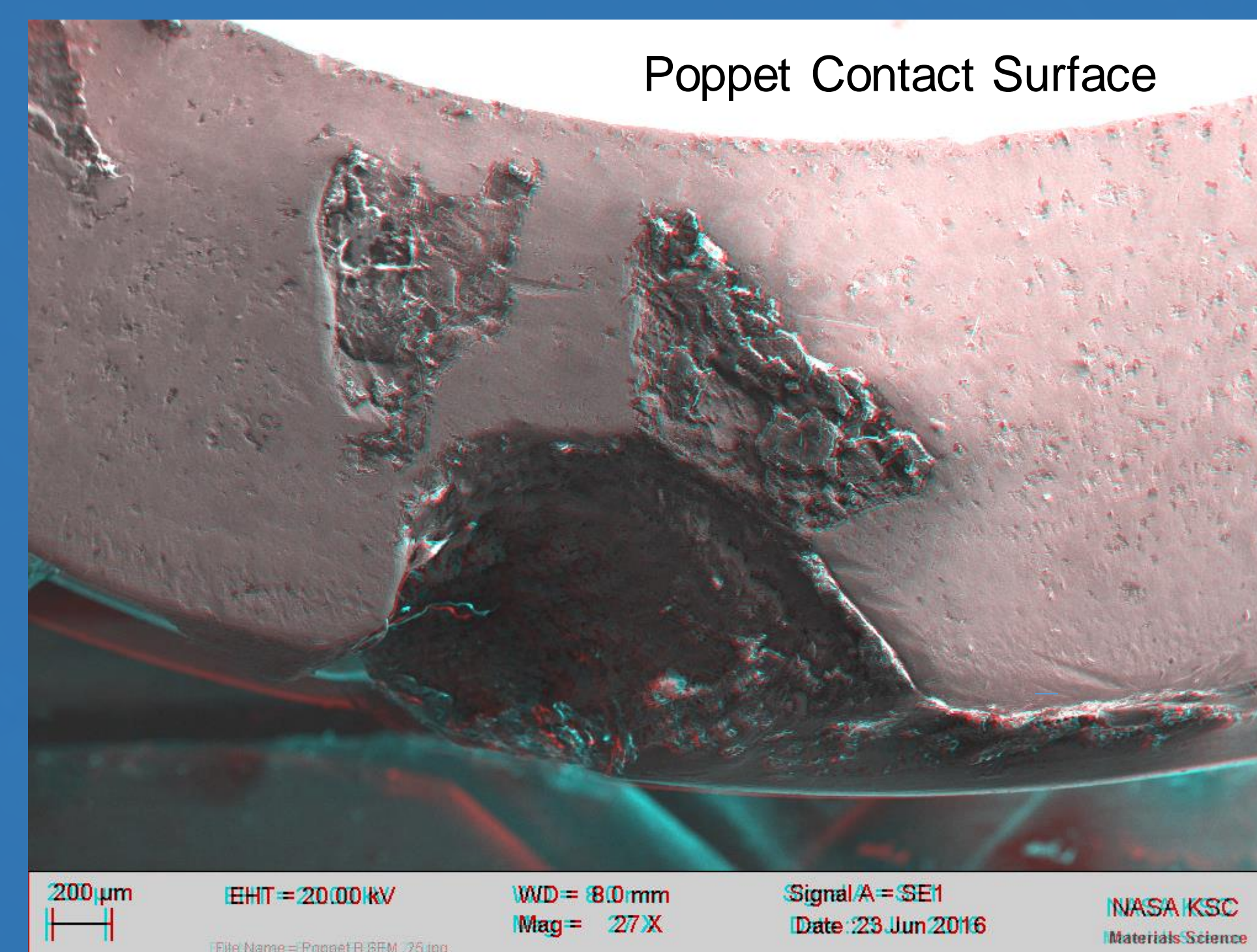
Discharge Fitting, piece of Seal Ring, Poppet, and Valve head as received in the lab



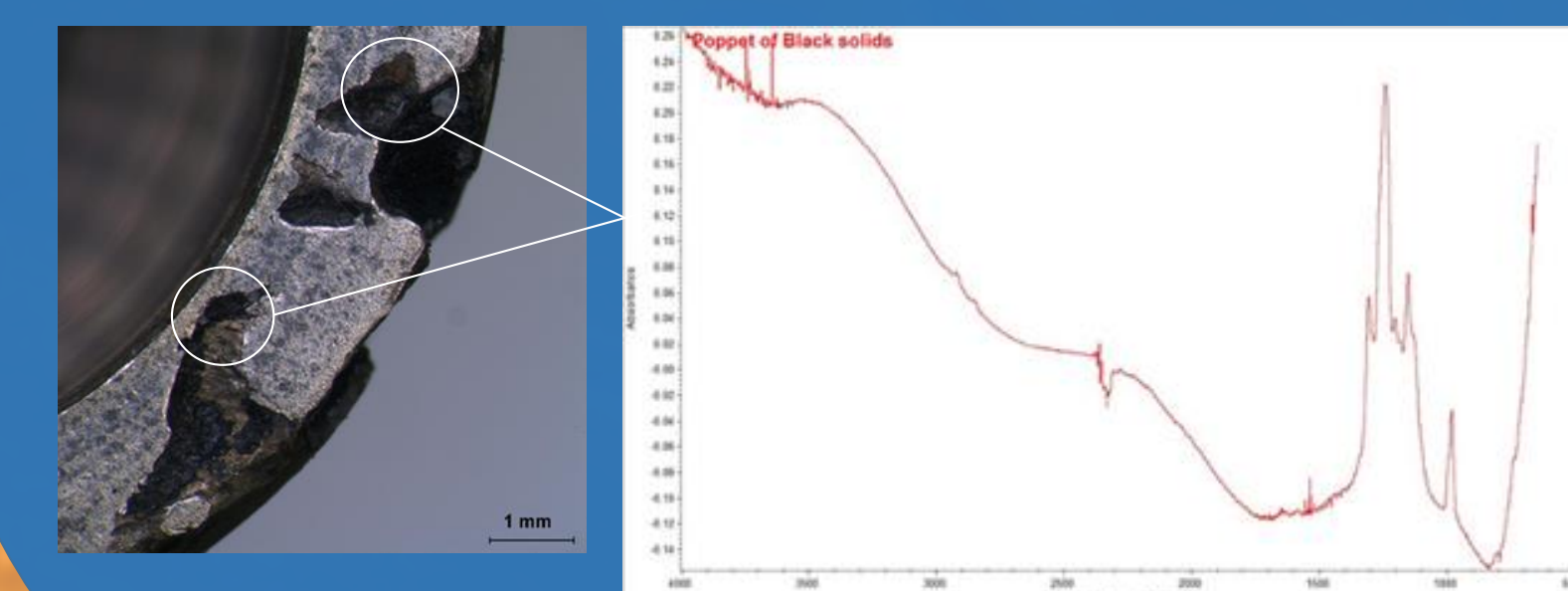
Damaged area of 17-4 PH Stainless Steel Discharge Fitting at 6.3 X magnification



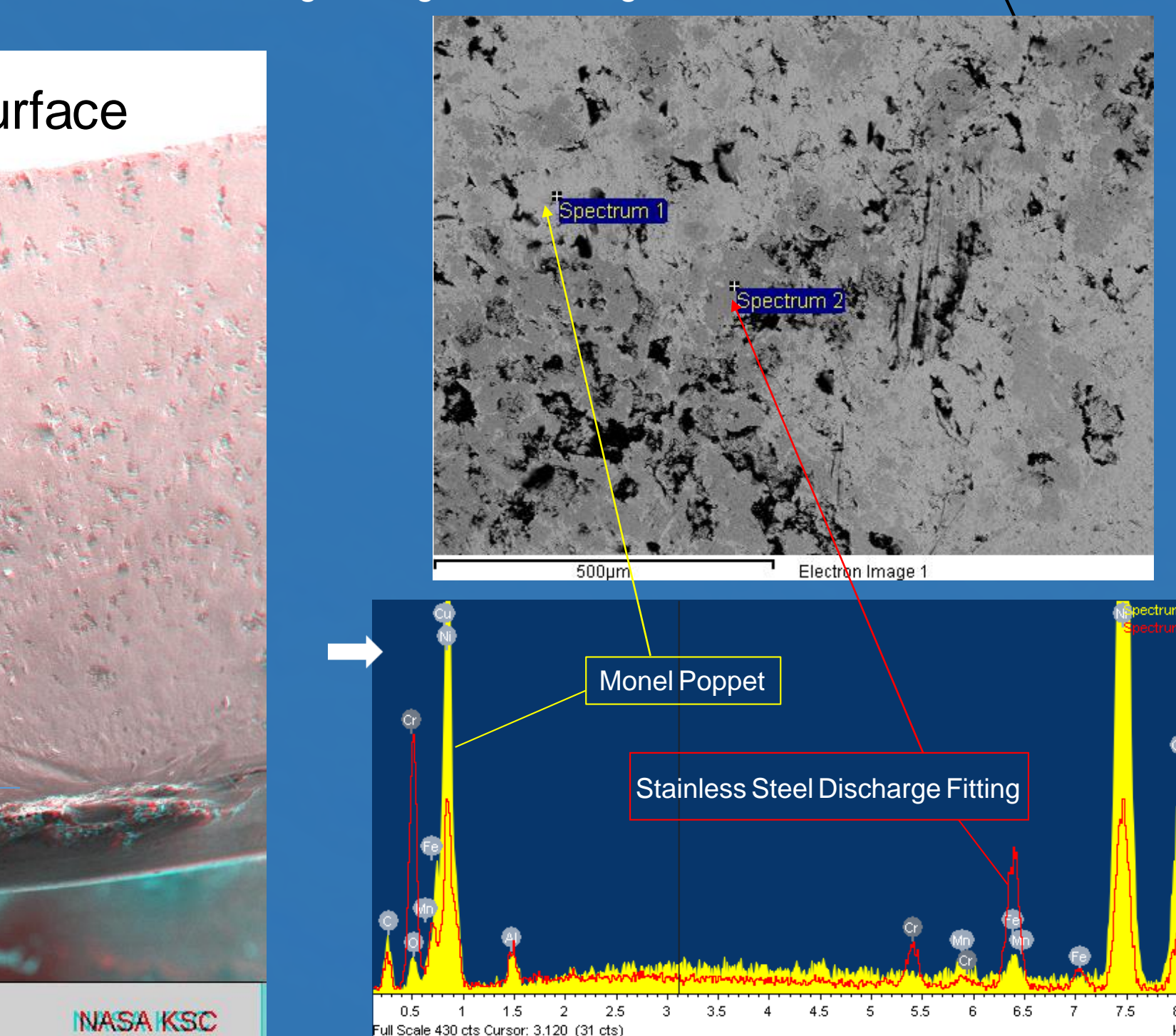
Damaged area of Monel K-500 Poppet at 6.3X magnification



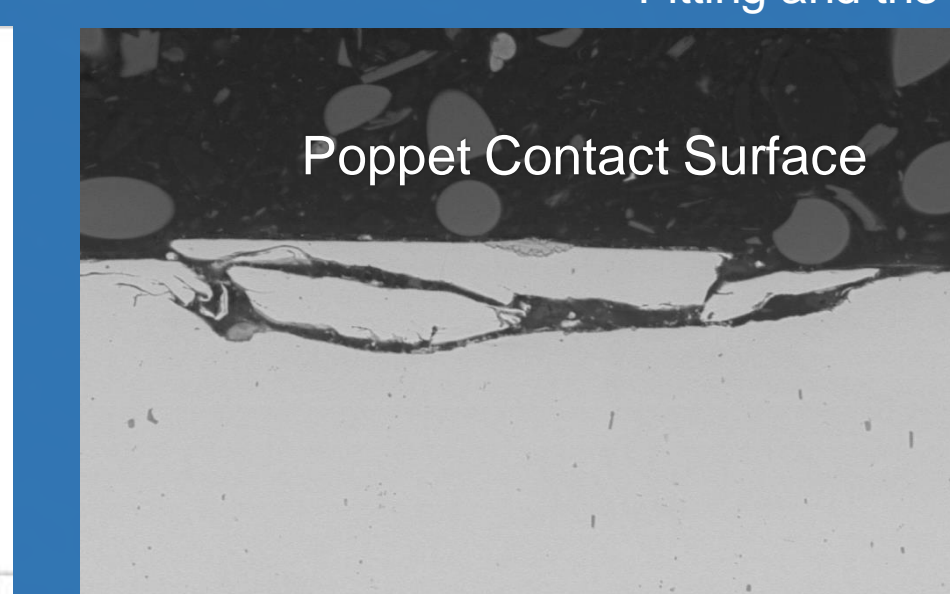
3D SEM image showing severe Fretting Corrosion/Wear effects



Fourier Transform Infrared Spectroscopy results showing that residue found in pits is composed of metal oxides and fluorinated grease



SEM BSD image and Energy Dispersive Spectroscopy (EDS) graph indicating material transfer between the Stainless Steel Discharge Fitting and the Monel Poppet contact surfaces



SEM image of Poppet's cross-sections showing evidence of spalling



Montage image at 50X taken from the Keyence Digital Microscope

Other Activities at KSC

- Volunteer at Robotics Mining Competition for STEM activities
- Volunteer for building a community garden in Titusville
- Facility tours
- Rocket launches
- KSC SLF 5K Run
- Environmental Division field experience
- Astronaut Crew Quarters tour
- Organized recreational events for interns



ISS Orbital Replacement Unit (ORU) Lithium Ion Battery Locking Spring Blade Failure Investigation



Photo of broken locking spring blade as received in laboratory



On-site photo of micro square lock where broken spring blade was configured

On-site inspection of Li Ion Battery with broken locking spring blade



On-site photo taken of the Lithium Ion battery with the broken spring blade



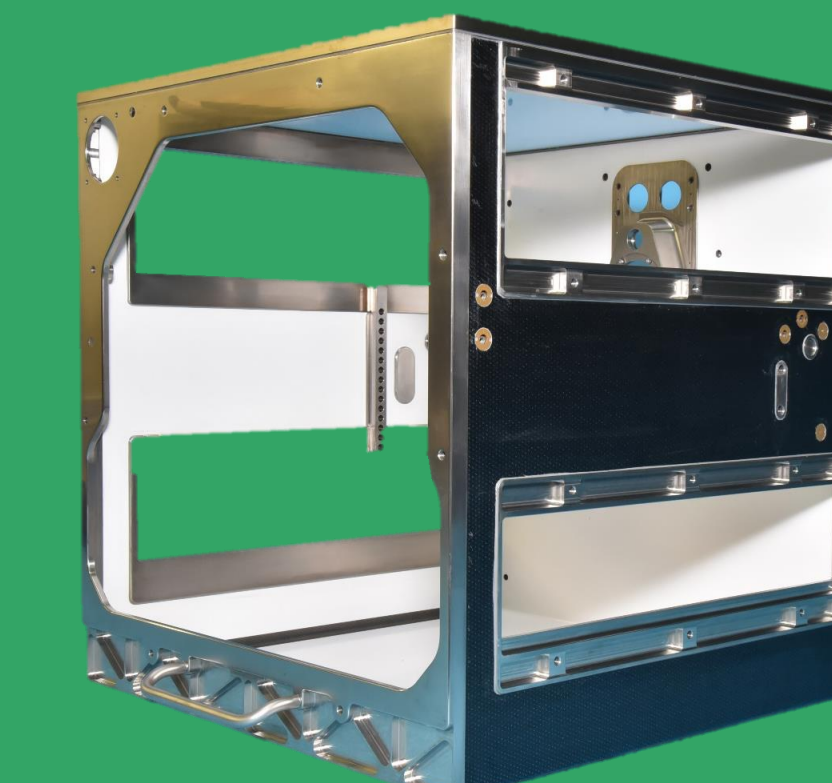
Stereomicroscope image of spring blade at 6.3X magnification

Advanced Plant Habitat M&P Engineering

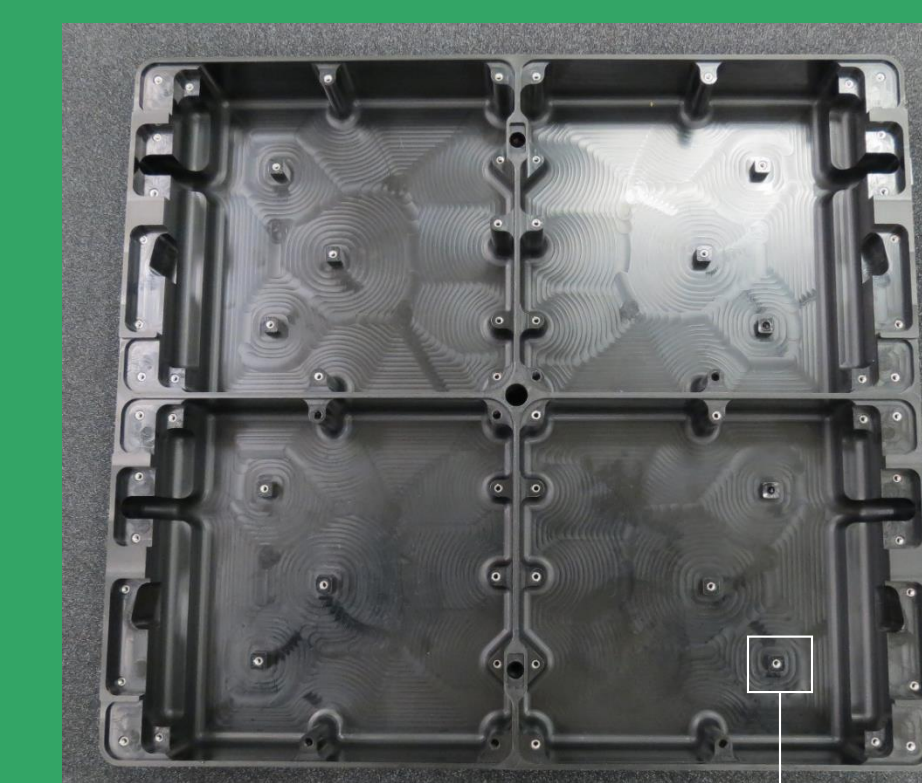
- Growth Chamber Composite Manufacturing
- Polycarbonate Root Tray Failure Investigation
- Mechanical Testing



Finished Growth Chamber



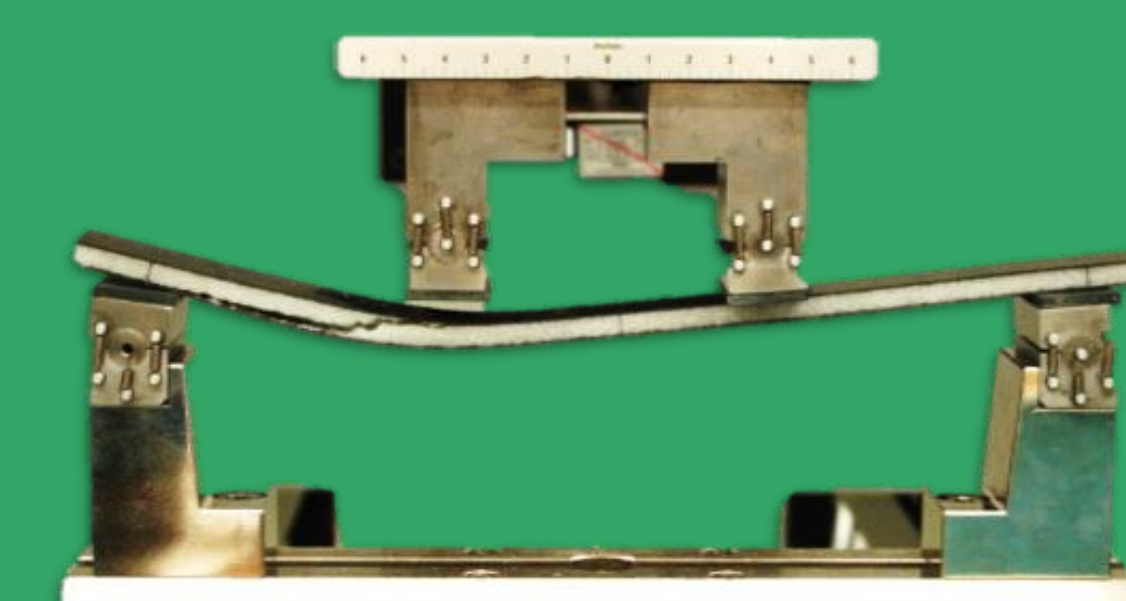
Growth Chamber on ground mock testing before packaging for flight to ISS



Polycarbonate Science Carrier root tray



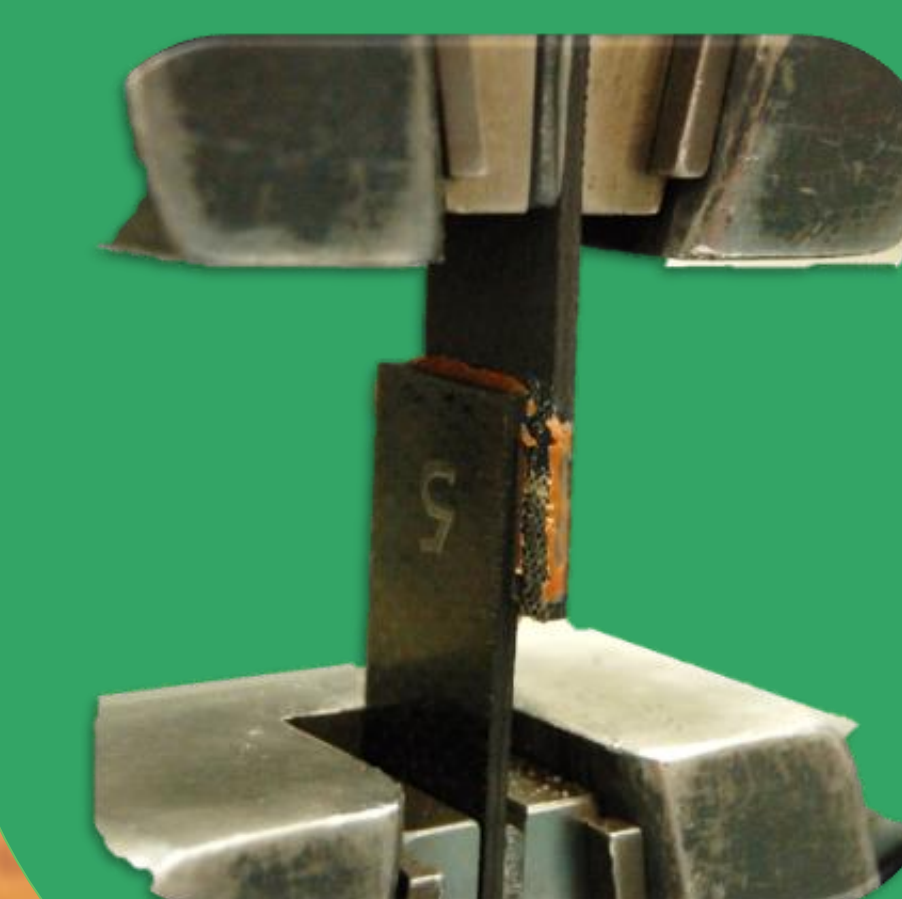
Preparing lap shear test specimens



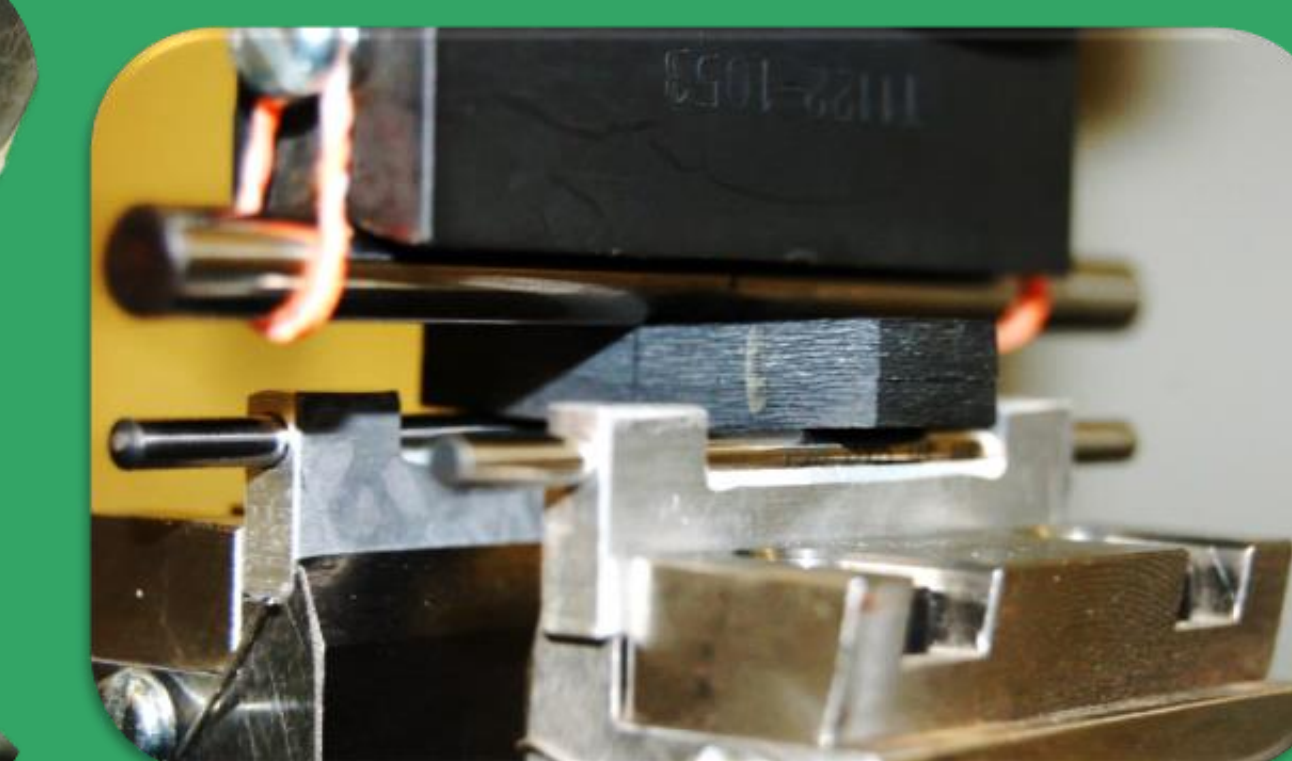
4-point Bend Test



Keyence Digital Microscope image at 100X showing cracks



Lap Shear Test



Short Beam Shear Test



Flatwise Tensile Test

Other Work Tasks

- Commercial Crew Program M&P Engineering Support
- Contamination Control
 - Particle Counting Project
- Trained on microscopes and lab equipment
- Mentor for summer interns
- Smaller failure investigations

Acknowledgements

- Mentor and role model: Clara Wright
- Supervisor: Steve McDanels
- Co-workers from Materials Science Branch
- Pathways Program Coordinators
- Contributors for failure investigation projects